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## **DEVELOPMENT OF A METHODOLOGY FOR THE ECONOMIC ASSESSMENT OF MANAGERIAL DECISIONS AS A FACTOR OF INCREASED ECONOMIC SECURITY<sup>1</sup>**

*The article notes that the emergence of such a phenomenon as the interdependence of security and development, the so-called security-development nexus, becomes a determinant during the development of strategic documents at all hierarchical levels.*

*It gives relevance to the search for methodological solutions that would on a strategic level take into account any potential threats to economic security, and on a tactical level provide for pragmatic actions that are not in conflict with the strategic development vector of business entities. The authors identify the instability factors that pose a real threat to economic security. They substantiate the expediency of forming a new model of the national economy development with a focal point on new industrialization. The article factors in the most important trends in the development of the global economy that determine the strategic vector of enhancing the economic security in Russia. It is ascertained that in the conditions of new industrialization, the intellectual core of the high-tech economy sector is formed by convergent technologies (NBICS technologies). The authors offer a methodological approach to the economic assessment of managerial decisions in the context of uncertainty. They also identify methodological principles that must be taken into account in developing a modern methodology for the economic assessment of business decisions. The principles include forming a preferred reality, or the so-called "vision of the future," the priority of network solutions as the basis for the formation of new markets; mass customization and individualization of demands, principal changes in the profile of competences that ensure competitiveness on the labor market, use of the ideology of inclusive development and impact investment that creates common values. The proposed methodology is based on the optimum combination of traditional methods used for the economic assessment of managerial decisions with the method of real options and reflexive assessments with regard to entropy as a measure of uncertainty. The proposed methodological approach has been tested in respect of the Ural mining and metallurgical complex.*

**Keywords:** economic security, economic assessment in the context of uncertainty, reflexive approach and regard for entropy in the assessment of managerial decisions, new industrialization, convergent technologies, methodology, real options

### **Introduction**

The challenges of strategic development faced by any country in today's environment are determined not only by the attained level of its social and economic development, but also by constantly emerging threats to its secure and sustainable development that are first of all associated with the transformation changes in the system of international relations. This factor that predetermined the appearance of the security-development interdependence phenomenon, the so-called security-development nexus [1], becomes determinant for Russia in the development of strategic documents at all hierarchical levels: federal, regional, and business.

In such conditions, it is essential to find methodological and methodical solutions to set strategic benchmarks of social and economic development with regard to potential economic security threats, on the one hand, and on the other hand to take into account pragmatically reasonable steps in the current period compliant, if possible, with the strategic development vector of economic actors.

Such pragmatism is to a large extent predetermined by a sharp increase in the number of significant parameters in conditions of globalization that in the aggregate determine the future image of the whole country, its regions, and individual business entities. Moreover, in our globalization era the volatility of these significant parameters grows continuously [2, P. 7], and the increasing interdependence of the

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country's socio-economic development and security makes it necessary to take this factor into account in making managerial decisions at all management levels.

The economic security theory is one of the actual and dynamically developing branches of the management science. The term "economic security" appeared after the American crisis of 1929–1933. The initial research from the perspective of economic security was conducted at the level of national economy, while further research expanded vertically to the macro-, meso-, and micro-levels. The multi-year research conducted by the Institute of Economics, Ural Branch of RAS, provided a real picture of economic security in Russia with regard to the situation in all its constituent entities in the main life spheres. Further on, this research was focused on identifying the possibilities for the prediction and assessment of threats to the social and economic development of regions. By taking this information into account timely managerial decisions can be made to promptly respond to crisis phenomena [3].

The external and internal challenges encountered today by Russia on the way of its development pose increased risks for national industrial companies, whose production, scientific, and technical potential forms the technological basis for the development of the Russian economy. The economic security from the perspective of the hierarchical economy structure should be considered at the following levels: global economy, national economy, regional economy (constituent entities for Russia), sector and industry economy, and economy of business entities. In today's conditions, the economic security of a business is determined mostly by the external environment rather than the company's internal state of affairs. In turn, such environment is determined both by the interaction with the respective counterparties of the company, and by the political and economic environment on the global level.

Thus, managerial decisions regarding social and economic development of any country or individual business entities cannot be made beyond the context of numerous instability factors leading to the growing uncertainty of the situation on macro-, meso-, and micro-levels. Here are some of them: geopolitical factors, including the evolvement of a unipolar world, global formation of "controlled chaos," and more complicated development conditions in the Third World countries. In Russia, the effect of these factors is intensified by the threatening wealth disparity, a conflict of national and corporate interests without efficient use of the administrative resource in national interests, and the volatile global environment on the markets of export resources most significant for Russia.

### **Instability Factors as a Threat to Economic Security**

One of the most important factors contributing to the unstable economic development of any country is the geopolitical factor. The release of global market forces (and in many cases, deprivation of the state of its economic power) became the reality for the majority of countries. It is this process that is most often interpreted as globalization. The only world country that consciously initiated this process with support from its economic and political elite was the USA [4, P. 284], which was one of the reasons for the formation of a unipolar world. This situation has caused the increase of geopolitical threats. The USA as the key player in the 21st century, that combines military power, huge economic potential, and a beneficial geographic location with access both to the Atlantic and the Pacific oceans, is not going to share its leading role in the world arena with any country. The famous American politologist, D. Friedman, notes that the USA has been a warrior country throughout all its history. Having emerged as a result of a war, this country continues fighting at an ever growing rate. Only its participation in major wars took 10 % of all the time of its existence. In the 20th century, it was already 15 %, and in the second half of the 20th century—22 % [5, P. 58]. But since the beginning of the 21st century, the USA has practically never stopped warfare in line with its national strategy pursuing five geopolitical objectives [5. 59–64]:

1. Domination of the US army in North America.
2. Elimination of any threat to the USA from any state in the Western Hemisphere.
3. Full control over the sea approaches to the USA.
4. Full dominance over the World Ocean to control the international trade system.
5. Making any country unable to resist the global superiority of the US naval forces.

According to D. Friedman, the US' military intervention has always pursued one and the same goal—not to allow the emergence of a strong state in Eurasia and to prevent the stabilization of the situation in the territories where a new powerful force could appear able to stand against its interests. Significantly, after a military intervention, the US military forces never stay in the invaded territories.

Their main objective has always been not to make an order, but, as was mentioned above, to destabilize the situation in the region that pose a potential threat to the US leadership.

The American financial policy plays a special role in preserving its leading positions. The stagnation and inflation of 1974–1976 that marked the end of the post-war boom led to a sharp drop in crediting volumes in the Third World countries. The debt of these countries grew from 130 billion dollars in 1973 to 612 billion dollars in 1982 and reached 2.5 trillion dollars in 2006 [6, P. 34]. However, the payments from the Third World countries amounted to 375 billion US dollars, which is 20-fold more than the amounts these countries received as aid from developed countries, first of all, the USA [6, P. 36]. The system of loans and other forms of financing helped America to achieve its objective of “holding the Third World countries' economy in an iron grip” [6, P. 36].

The growing instability of today's world and the geopolitical factor are associated with the increasing economic disparity both among and within individual countries. In general, half of the world population live on less than 2 dollars a day.<sup>2</sup> The situation in Russia is characterized by the extreme disparity of cash flows, that is salaries, social payments, investment and business income. According to RBC, in 2015 among major Russian state companies, 12 board members of Rosneft received maximum remuneration: 26 million rubles per month on average versus an average monthly staff salary of some 550 thousand rubles. The salaries paid to the management of private companies are also rather high. In 2014, the board members of NOVATEK earned 17 million rubles and Lukoil board members received 9 million rubles per month on average. For five years (from 2009 to 2013), the official expenditures of ten major Russian companies on their top managers grew 2.3-fold, while the average per capita income grew only by 53 % [7, P. 15]. In 2014, the average monthly salary of federal government officials amounted to 109,100 rubles, which is 3.3-fold higher than the average salary in economics, but 5-fold lower than the monthly average salary paid to Rosneft employees. It should be noted that in the majority of developed and developing countries the salaries of government officials to a certain extent correspond to those of workers carrying out comparable activities. In Russia, however, the salaries of budget employees are determined in the course of “political-bureaucratic haggling on the federal level with regard to the budget restrictions of regions” [7, P. 17].

One of the key factors determining the income disparity in Russia is the region of residence. In 2012, the attempt to determine the salaries for budget employees in accordance with the average salary for the region in pursuance of the May orders of the President did not contribute to the reduction of social disparity. The remuneration paid to top managers of major national companies equals to that paid to foreign companies' managers. However, such correspondence of salaries is not characteristic of such budget sectors as health care, science, and education. The relevance of reducing the economic disparity grows in view of Russia's current recession. Such disparity drives increased social tension, which may pose additional threats to economic security.

Lack significant improvements in the country's socio-economic situation led to a sharp decrease in positive performance assessments by the Russians of almost all ministers of the current Russian government. Such conclusion was made based on the survey conducted by VCIOM. Only three ministers (S. Shoigu, Minister of Defense, S. Lavrov, Minister of International Affairs, and V. Puchkov, Minister of Emergency Situations) were given positive assessments<sup>3</sup>.

Improving the economic security of the national economy in the conditions of the above-mentioned instability raises special requirements for the administrative resource quality. Most often, this resource is determined as a system of management methods and means used by state authorities and officials in order to address both strategic and current tasks [8, P. 33]. The determining role of the administrative resource is obvious not only in the modernization of the country's technological basis, but in forming a new high-tech sector of the economy. It should be noted that the Sverdlovsk region was one of the first Russian regions that implemented regulatory control assessment on a permanent basis. Such assessment makes it possible to develop weighted, balanced solutions that meet the interests of various social groups, and to identify both express and latent administrative barriers in the adopted regulatory acts. However, the actual effect of using this administrative resource proved to be low.

In modern conditions, when new industrialization becomes the determining trend in the development of national economy, it would not be correct to speak only about the administrative

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<sup>2</sup> World Data Sheet. Washington, D.C. Population Reference Bureau, 2006.

<sup>3</sup> Khamraev, V. (2016, Apr il 5). U pravitelstva pal sredniy bal [Drop of the government's grade point average]. Kommersant, 57, 2.

resource, since efficient economic development will be objectively based on the joint use of both administrative and business resources. The reconciliation between the economic interests of the state and those of the business environment, in particular, the corporate economy sector, is an important methodological challenge, the solution of which is to a large extent determined by the motivation potential of the respective structures [9, P. 240–245]. Moreover, such reconciliation involves identifying the contribution of the administrative resource into the final results of development, on the one hand, and determining the economic efficiency of its use, on the other hand.

Currently, there is no generally accepted methodology for assessing the value of the total resources invested in production development both by the state and by other participants of the investment process. Most frequently, traditional approaches applied for assessing the market value of investment resources are used for this purpose [10, P. 33]. The results obtained based on such approaches do not make it possible to evaluate the real return on the investments made by individual participants of the investment process. There is recent research claiming that the “investment value of all aggregate assets involved in the program cycle by the participants of investment programs differs from their market value chiefly because of the impact of the administrative resource” [9, P. 39]. Though the content of the economic assessment of the administrative resource is generally determined [8, P. 42], there is no generally accepted methodological approach to assessing the efficiency of administrative or business resources used.

In view of the unstable global economy and the impossibility to forecast the dynamics of oil prices, which largely determines the country's capabilities for economic development, the instability tendencies in Russia grow due to its inadequate export-resource development model. According to a number of researchers, this model blocks the progress considerably and dooms the country to the “way of accumulation of unsolved vital issues and aggravation of contradictions, which makes it hard to predict its integrity in a historical perspective” [11, P. 4].

### **New Industrialization as a Strategic Approach to Enhancing Economic Security**

Forming an efficient model of national economy development is one of the most important factors in overcoming its current crisis. The central constituent element of such model is new industrialization intended to ensure an intensive type of expanded production, a new quality of human capital, and a high technology base of Russia's economy as a key factor in enhancing its competitiveness and ensuring economic security [12]. After we systematized the consequences of the national economy de-industrialization, took into account the global trends towards the re-industrialization of the developed economies, and analyzed the Russian theoretical and practical research in the field of neo-industrialization, we formed our own vision of these problems and specified the concept of new industrialization that we had introduced earlier.

In the context of ever-growing economic disparity on all hierarchical levels and increased social risks, new industrialization may become an effective component of the country's non-resource-oriented economic development model only when it is implemented with regard to the principles of impact investment creating common values and to closely associated principles of inclusive development. The ideas of inclusive development are important not only in terms of building a fair political and economic world order and making sure that all people can take part in the life of the society, but also from the perspective of ensuring structural and spacial inclusion. Moreover, an important aspect of new industrialization is the focus on the inclusive economic growth that makes it possible to take into account the growth rates of macro-economic indicators and to improve the distribution of such growth results [13, 14, P. 99–102].

In view of the foregoing, new industrialization is a synchronous process of creating new high technology sectors of economy along with an efficient innovative modernization of its traditional sectors and approved qualitative changes in the interaction between the technical-economic and socio-institutional spheres based on the principles of inclusive development and impact investment through interactive technological, social, political, and management changes [15].

This article pays special attention to such important element of the new industrialization process as the development of the high-tech economy sector [16]. It is this sector that triggered intensive technology development in the second half of the 20th century enabling the leading countries in the industry to determine global geopolitical transformations. The absence of clear goals and priorities in the technology and innovation policy, mostly identical forms of research organization, and low



share of the science-consuming industry based on imported, not domestic, technologies prevented Russia from building an adequate industry in terms of technological, structural, and environmental parameters that would meet the demands of the new technology wave. New industrialization is not possible without the emergence of national companies in brand new industry markets that currently do not even exist. In the opinion of many analysts, which we share, Russian companies may have a certain niche only in the markets that are not yet created<sup>4</sup>. Expectedly, in the conditions of such uncertainty the methodological grounds for making managerial decisions on various hierarchical levels require substantial development.

The strategical vector of increasing the economic security of Russia must be formed with regard to the global economy development trends that will determine its image in compliance with the new technology wave. It seems that among the most essential trends there are those related to the growth of markets based on network solutions leading to cardinal changes in the value added chains; the formation of a network approach in organizing research, where multi-disciplinary centers are used as a platform for the cooperation between research and technological organizations combined in territorial innovation systems through an innovative infrastructure—collective access centers, open-access laboratories, etc.; and the increasing role of companies that address the emerging challenges by combining the best technologies available with various demand formats in a comprehensive manner and with minimum costs<sup>5</sup>. Equally important are the trends evidencing a more complicated nature of ethical, motivational, and psychological problems due to the society's unpreparedness to accept a whole range of innovations; the trends determining cardinal changes in the profile of competences that are in demand in the labor market and leading to substantial changes in the structure of population employment, as well as the trends of forming a “portfolio of competences” based on the assessment of the expected demand of companies, which implies the emergence of a new higher education model.

### **Convergent Technologies as an Intellectual Core of the High-Tech Economy Sector in the Context of New Industrialization**

Convergent technologies traditionally include nano-technologies, bio-technologies, information technologies, and cognitive technologies. Their mutual influence and interpenetration are called NBIC convergence. This term was introduced in 2002 by M. Roco and W. Bainbridge in their report *Converging Technologies for Improving Human Performance* presented at the World Technology Evaluation Center. These technologies distinguished by their interdisciplinary character can to a large extent determine the development level of the technology base and the research intensity of the national economy. However, such an important factor of global development as the emergence of new forms of life activities and the possibility of constructing social reality remains overlooked. The technologies developing in this area were named socio-humanistic technologies, or S technologies. Their development prospects are promising in a number of areas, including high technology formation from the perspective of humanitarian and natural science knowledge convergence, as well as the building of models of active innovative development environments focused on multiple distributed sources of innovations.

The importance of these technologies allows us to speak not only about NBIC technologies, but about NBICS technologies. Apparently, the regularities of the interaction processes between technology, man, and society and the development of specific methods and means of influence on such processes add to the peculiarities of the new economy development and require substantial adjustments in the methodology of assessing managerial decisions. Some researchers reasonably, in our opinion, believe that the coming seventh technological wave will be interpreted as socio-humanistic [17, P. 87–88]. In view of the foregoing, we understand the convergent technologies as the technologies that determine a brand new technology base of economy in compliance with environment protection requirements,

<sup>4</sup> Natsionalnaya tekhnologicheskaya initsiativa (pdf). Peterburgskiy mezhdunaronyy ekonomicheskyy forum (18 iyunya 2015). [National technological initiative Briefing (pdf). St. Petersburg International Economic Forum]. (June 18, 2015). Retrieved from: <http://government.ru/media/files/T9Crayp8PsBQU6hdVA10SsDlu2XvCvYG.pdf> (date of access: February 18, 2016); Denisov, D. (2015, July 27). Rynki iz niotkuda [Markets from nowhere]. *Biznes zhurnal* [Business journal].

<sup>5</sup> Chulok, A. Nauchno-tekhnologicheskoye razvitie Rossii. Strategiya i praktika [Science and technology development in Russia. Strategy and practice]. Retrieved from: <http://www.rusventure.ru/ru/press-service/massmedia/detail.php?ID=61386> (date of access: February 18, 2016).

have a high economic potential of practical application, and are crucial for the social and economic development of the country both from economic and national security perspectives.

Implementing the main provisions of NBICS technologies in the context of the new industrialization of its economy will enable Russia to introduce non-traditional methods of applying research developments, to use new principles of inter-sector technology transfer and transfer of technologies from science to real sector, and to activate the methods of managing technological platforms in the high technology sector. The appearance of brand new products and services based on the convergence of technologies and the implementation of the logics and tasks of their development into Russia's research and technology policy and into the accepted system of industrial and territorial management of the society as a whole make it possible to form new industries emerging as a result of the convergence. These processes involve shifting to renewable energy sources and resource saving high-end technologies with a priority focus on the environment at all stages of high technology development and implementation, or in other words the priority of "nature-like" technologies that change the resource involvement paradigm based on the natural resource turnover.

Despite all positive aspects of NBICS technologies, we can't overlook the increasing technological threats associated with the consequences of extensive technology use and the ever growing gap between technology and ethical and civilization assessments. All of the aforesaid suggests that the traditional methods used for the economic assessment of managerial decisions in the context of globalization, material changes in the development trends, and the priority of inter-disciplinary research as the basis for forming the national economy technology base require significant modernization.

### **Methodological Approach to the Economic Assessment of Managerial Decisions**

The global development summit held in 2015 in New York within the scope of the 70th Session of the UN General Assembly approved new sustainable development goals (17 goals and 169 associated targets), and established the global community development benchmarks for the next 15 years intended to eradicate poverty in all its forms and everywhere [18, P. 119]. Such comprehensive objective and sustainable development targets exclude the need to search for more efficient ways of achieving these goals individual for each country.

The importance of choosing the preferred areas of strategic development of the national economy, individual regions, major economic actors, their investment and innovation activities requires that we advance the methodology for the economic assessment of managerial decisions. It should be noted that this article deals not with the development of the modern institution of regulatory control assessment aimed at creating favorable terms for entrepreneurial and investment activities, identifying optimum regulation limits in the economy, etc. The institution of regulatory control assessment was formed in Western Europe back in the 70s of the 20th century [19], while in Russia research on regulatory control assessment began only closer to the end of the first decade of the 21st century. Generally, the object of such assessment is the law-making practice. According to a number of researchers, domestic experts have made least progress in developing reasonable approaches to evaluating the efficiency of regulatory control assessment [20, P. 81], which makes methodological research in this regard the most prospective area for the development of regulatory control assessment in Russia. However, it should be taken into account that European countries already consider expanding the types of activities subject to regulatory control assessment, and using not only quantitative, but also qualitative indicators in the respective calculations [21].

After the systematization of multiple research with a view to determining especially significant factors that increase the geopolitical, financial, technological, economic and social instability in the modern society and to identifying new trends of technological development, we can offer important, in our opinion, methodological principles that may be used in forming a new methodology for the economic assessment of managerial decisions:

- Taking into account the interdependence of security and socio-economic development;
- Forming the preferred reality, or the so-called vision of the future as one of the scenarios of socio-economic development;
- Combining strategic development benchmarks and tactical goals of their attainment, which among other things implies taking into account the uncertainty through the evaluation of entropy and real options, and using a reflexive approach;
- The priority of network solutions as the basis for the formation of new markets;

- Cardinal change of value added chains;
- Mass customization and individualization of demands;
- Principal changes in the profile of competences ensuring the competitiveness in the labor market;
- Using the ideology of inclusive development and impact investment that creates common values;
- Bilateral assessment of managerial decisions with regard to the expected socio-economic, environmental, ethical, and political consequences.

Based on the above methodological principles the Institute of Economics, Ural Branch of RAS, developed a methodological approach to the economic assessment of managerial decisions both on the regional level and on the level of individual business structures. The proposed methodological approach was tested on the mining and metallurgical complex of the Middle Ural. This complex is an important element in the structure of its economy and in 2014 had a share of 70.3 % in the total volume of industrial production. It numbers 110,000 employees, which makes 7 % of the Ural working population. The holding structure includes 34 large and medium-size mining and metallurgical companies of the Sverdlovsk region and accounts for 95.0 % of the industry production. The share of mining and metallurgical product exports in the overall export structure amounts to 56 %.

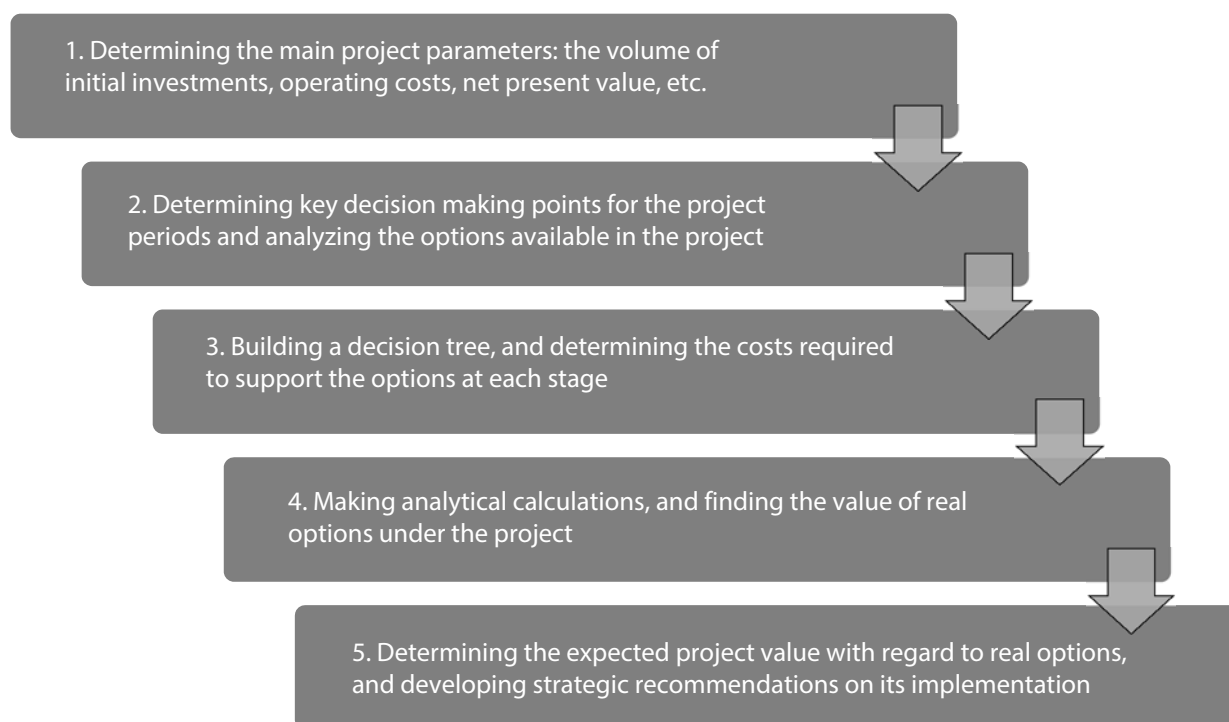
The above methodological principles underlying the economic assessment of managerial decisions are rather universal in terms of their applicability in various economy sectors. But the methodological assessment tools differ substantially depending on the development vectors of specific complexes. The mining and metallurgical complex has an important role from the perspective of the region's economic security. The initial stage of working out its development strategy is creating the “vision of the future,” or in other words a new technological image of the mining and metallurgical complex [22].

The biometric analysis and the analysis of patent activity revealed the relation between the development of metallurgy and adjacent industries, first of all nanotech industry. The method of main components was used to determine the indicators providing stage-by-stage characteristics of the new technological image of the Ural metallurgy [16, P. 39]. Our research showed that the Ural has the required preconditions to consider the future mining and metallurgical complex as a network community of competitive structurally balanced production facilities with personnel possessing a principally new profile of competences, and products fully meeting the individual needs of the high technology sector for research-intensive products and services, and the brand new demands of traditional economy sectors.

The vision of the prospective technological profile of the Ural mining and metallurgical complex became the basis for the development of methodological grounds for the economic assessment of managerial decisions in individual complex sectors and with respect to individual business entities. As an example, below there are results of some research.

The Ural mineral and resource base is distinguished by a multi-component content of its ore resources. A complex character is also typical of the anthropogenic resources, the colossal volume of which made them an important source to satisfy the metallurgy demands for iron, copper, zinc, nickel, chrome, vanadium, rare earth elements, etc. The strategic importance of involving these resources in processing and sharp fluctuations in the global market of metals necessitate the adjustment of traditional methods used for the economic assessment of managerial decisions in this area in the context of increased uncertainty of the conditions for the implementation of these decisions. The economic assessment includes the following determining stages: choosing the optimum time for investments, determining the effect of investments on the sectoral structure of the mining and metallurgical complex, using the alternative methods to calculate the prospective prices for metals contained in the anthropogenic resources, and taking into account the operational flexibility in the implementation of business decisions on their processing.

As research shows, the adaptability and flexibility of possible business decisions, including those on involving anthropogenic resources in processing, can be taken into account based on the methodology of real options [23]. For the first time, the methodology of real options was applied as the basis for the methodological tools used to assess projects in the mining industries in the second half of the 20th century [26]. In this model of investment projects assessment, the prices for raw materials were considered as stochastic, as the significant price fluctuations are a reality in this economy sector. Special attention in this model is paid to managerial control over the volume of production, as it also



**Fig. 1.** *Economic assessment algorithm for decision-making with respect to the processing of anthropogenic resources based on the methodology of real options [27, P. 92]*

changes depending on the price fluctuations. This model is considered a classical variant of using the method of real options with respect to the conditions of the mining and metallurgical complex. Rio Tinto Holding, the largest world producer of iron ore raw materials, extensively applies the method of real options to evaluate its investment projects [25]. Many analysts in the field of metallurgy production development, financial and investment companies, and banks actively support the use of real options to assess the investment projects in mining and processing of natural resources [26].

In our research, we combined two models of option evaluation to adapt the methodological developments of real options to making decisions on a complex use of the Ural anthropogenic resources [29]. First of all, a decision tree is built to determine the key aspects of implementing the decision made and the time lines for embedding real options. Then, the value of the identified real options is determined based on the adapted Black–Scholes model, and the total strategic value of this solution is analyzed with regard to the obtained assessments for the two models. The research enabled us to develop an economic assessment algorithm relating to the use of anthropogenic raw materials based on the methodology of real options. This algorithm consists of five stages (Fig. 1).

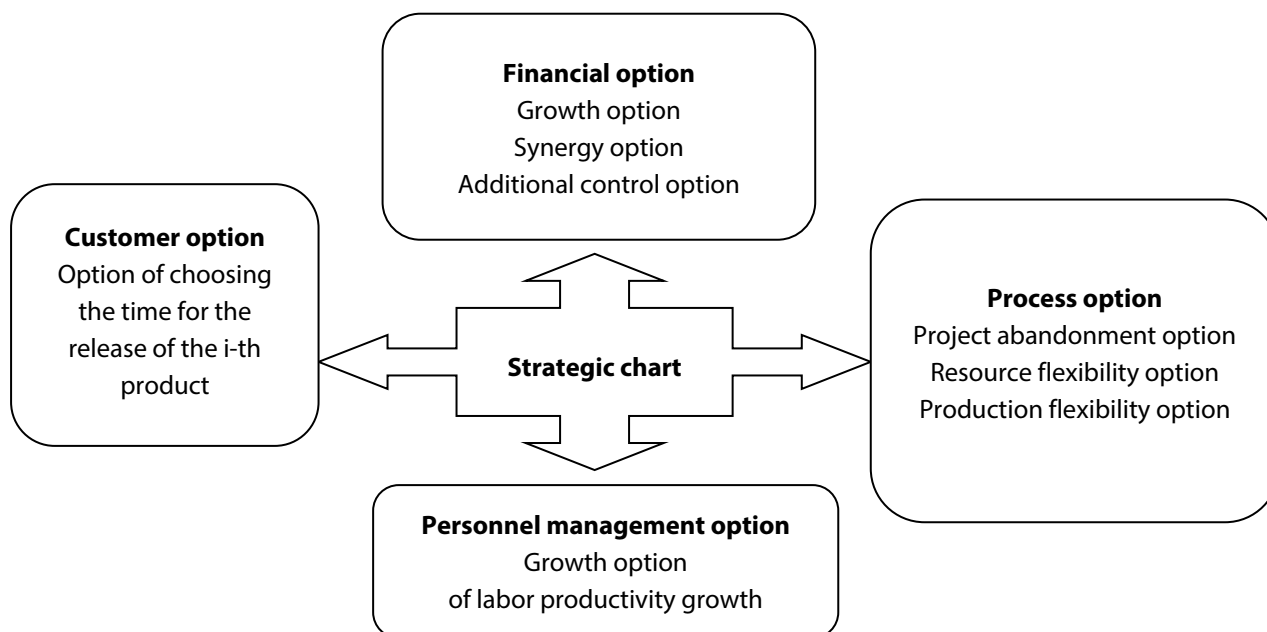
The method of real options is more and more often used in the assessment of managerial decisions regarding the development of individual business structures. At the Chelyabinsk Zinc Plant, the use of the methodological tools offered by us, including the method of real options, proved the expediency of building new capacities for processing zinc-containing waste from steel production with obtaining a number of valuable components.

The new approach to using the method of real options is offered with respect to the assessment of managerial decisions at the largest Pipe Metallurgical Company (TMK) in Russia [28]. A distinguishing feature of this approach is embedding real options into the chart of the company's balanced indicators (Fig. 2) [29, P. 15]. The chart demonstrates that practically any option can be presented as a key performance indicator. It means that taking the options into account in its development strategy will allow TMK to diversify its risks and to increase the effect of the operating and financial synergy. Such approach makes it possible to form the company's development strategy as a portfolio of real options.

In this case, the project's strategic value was assessed based on the binary decision tree and the Black-Scholes model.

A characteristic feature of the mining and metallurgical complex is the active development of integration processes. The potential multi-vector development of these processes, the unpredictability of certain consequences of the integration interactions, and the necessity to take into account the economic interests, often contradictory, of the subjects of these interactions predetermined the need





**Fig. 2.** TMK's strategic chart with regard to real options [29, P. 15]

for a non-standard approach to the economic assessment of these processes. The approach that we developed includes a number of successive stages of economic assessment. It introduces entropy into the practice of economic calculations as a means of measuring uncertainty, as well as reflexive evaluation of the decisions made at the first and final stages of such evaluation [30].

The proposed methodological approach to assessing managerial decisions in various fields is getting increasingly wide support. Thus, in his work prof. A. Yu. Kazak supports the idea of using the method of real options as a modern tool used not only to substantiate the efficiency of investment decisions, but also to determine the business value. Actually, it is about applying the theory of financial options to real assets. A. Yu. Kazak offers the following order of investment projects assessment: identifying all the risks associated with the project implementation, making scenarios and preliminary risk assessment; evaluating the entropy, determining a preliminary list of real options ensuring the project flexibility subject to the identified risk factors, assessing real options, and calculating the efficiency of risk-bearing projects [31].

### Conclusion

The numerous factors of geopolitical risks, unstable development of the national economy (unexpected political decisions, individual changes in business operation conditions, etc.), and the emerging threats to the economic security of the whole country and of individual business structures make it necessary to develop a methodology for the economic assessment of managerial decisions at various hierarchical levels.

Some basic principles of such methodology proposed in the article were used in developing methodological tools for the assessment of managerial decisions at the level of individual business structures of the mining and metallurgical complex. Its efficient testing emphasizes the need for profound research in this area. Further objectives in this research area involve developing a methodology for the economic assessment of managerial decisions that would make it possible to combine traditional methods with complementary approaches promoting the methods of real options and the reflexive approach ideas, and that would take into account entropy in calculations as a measure of uncertainty. The economic assessment of managerial decisions using the above approaches makes it possible to implement the most reasonable decisions with minimum risks and thus to enhance the economic security on various hierarchical levels of the national economy.

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## References

1. Spear, J. & Williams, P. (2010). *Security and development in Global Politics: A Critical Comparison*. Wash, DC: George-town University Press, 352.
2. Kokoshin, A. & Bartenev, V. (2015). Problemy vzaimozavisimosti bezopasnosti i razvitiya v strategicheskoy planirovani v Rossiyskoy Federatsii. Ot tselepolaganiya k prognozirovaniyu [Problems of security and development interdependence in Russia's strategic planning. From goal setting to forecasting]. *Problemy prognozirovaniya [Problems of forecasting]*, 6, 6–17.
3. Kuklin, A. A., Bystray, G. P., Okhotnikov, S. A. & Vasilyeva, E. V. (2015). Ekonomicheskaya tomografiya: vozmozhnost predvidet i reagirovat na sotsialno-ekonomicheskie krizisy [Economic tomography: ability to foresee and respond to social and economic crises]. *Ekonomika regiona [Economy of region]*, 4(44), 40–54.
4. Martin, G. P. & Shumani, Kh. (2001). *Zapadnaya globalizatsii: ataka na protsvetanie i demokratiyu: per s nem [The global trap: globalization and the assault on prosperity and democracy: transl. From Germ.]*. Moscow: Alpina Publ., 335.
5. Fridman, D. (2010). *Sleduyushchie 100 let. Prognoz sobyitiy XXI veka [The next 100 years. A forecast for the 21st century]*. Moscow: Eksmo Publ., 336.
6. Hiatt, S. *Igry ekonomicheskikh ubiyts [Games of economic killers]*. 2d revised ed. Moscow: Pretekst Publ., 447.
7. Yakovenko, D. (2016). Izvestnyy bankir i selskiy vrach [Known banker and country doctor]. *Ekspert [Expert]*, 9 (February 26 — March 6), 13–17.
8. Kamenetskiy, M. I. & Yaskova, N. Yu. (2015). Administrativnyy resurs kak faktor povysheniya effektivnosti sistemy gosudarstvennogo upravleniya [Administrative resource as a factor of improving the system of public administration]. *Problemy prognozirovaniya [Problems of forecasting]*, 2, 33–42.
9. Peregudov, S. P. (2003). *Korporatsii, obshchestvo, gosudarstvo. Evolyutsiya otnosheniy [Corporations, society, and state. Evolution of relationships]*. Moscow: Nauka Publ., 352.
10. Kichik, K. V. (2012). *Gosudarstvennyy (munitsipalnyy) zakaz Rossii. Pravovyye problemy formirovaniya, razmeshcheniya i ispolneniya [State (municipal) order of Russia. Legal problems of formation, placing, and execution]*. Moscow: Yustitsinform Publ.
11. Mikulskiy, K. (2016). Sistemnyye riski rossiyskogo obshchestva [System risks of the Russian society]. *Obshchestvo i ekonomika [Society and economics]*, 1, 4–7.
12. Gubanov, S. (2012). *Derzhavnyy proryv. Neoindustrializatsiya Rossii i vertikalnaya integratsiya [Power breakthrough. Neoindustrialization of Russia and vertical integration]*. Moscow: Knizhnyy Mir Publ., 224. (Sverkhderzhava).
13. Amitai Etzioni *Reindustrialization Of America*. (1983). Review of Policy Research, 5, 677–694. Retrieved from: <http://ideas.repec.org/a/bla/revpol/v2y1983i4p677-694.html> (date of access: 14.08.2015).
14. Bukhvalov, N. Yu. (2016). Inklyuzivnoye razvitiye v ramkakh sovremennoy tekhniko-ekonomicheskoy paradigmy [Inclusive development in the context of modern technical and economic paradigm]. *Aktualnyye problemy razvitiya Rossii i ee regionov. Mat-ly II vseros. nauch.-prakt. Konf [Actual problems of development of Russia and its regions. Materials of the 2nd All-Russian Scientific-Practical Conference]*, 1. Kurgan: Dammi Publ., 328.
15. Romanova, O. A. & Sirotin, D. V. (2015). New Technological Shape of Basic Branches of RF Industrial Regions. *Economic and social changes: facts, trends, forecast*, 5(41), 27–44.
16. Bendikov, M. A. & Frolov, I. E. (2007). *Vysokotekhnologichnyy sektor promyshlennosti Rossii. Sostoyanie, tendentsii, mekhanizmy innovatsionnogo razvitiya [High technology industry sector of Russia. Condition, tendencies, and mechanisms of innovation development]*. Moscow: Nauka Publ.
17. Lepskiy, V. E. (2010). *Refleksivno-aktivnyye sredy innovatsionnogo razvitiya [Reflexive active environment of innovation development]*. Moscow: Kogito-Tsentr Publ., 255.
18. Denisov, A. & Denisova, E. (2016). O novom obraze budushchego [About the new vision of the future]. *Ekonomicheskie strategii [Economic strategy]*, 1, 118–132.
19. Deighton-Smith, R. & Jacobs, S. (1997). *RIA: best practices in OECD countries/ OECD*. Retrieved from: <http://www.oecd.org/gov/regulatory-policy/35258828.pdf> (date of access: 13.04.2016).
20. Turgel, I. D. & Veybert, S. I. (2015). *Institut otsenki reguliruyushchego vozdeystviya v stranakh SNG. Kompleksnyy analiz [Institution of regulatory control assessment in cis countries. Comprehensive analysis]*. Ekaterinburg: Ural Institute of Administration, Russian Presidential Academy of National Economy and Public Administration, 92.
21. Staschen, S., Dermish, A. & Gidvani, L. (2012). *Regulatory Impact Assessment Methodology: Towards Evidence Based Policy*. Making in Financial Inclusion. Bankable Frontier Associates. Retrieved from: [http://bankablefrontier.com/wp-content/uploads/documents/Regulatory-Impact-Assessment\\_BFA-Concept-Note.pdf](http://bankablefrontier.com/wp-content/uploads/documents/Regulatory-Impact-Assessment_BFA-Concept-Note.pdf) (ddate of access: 13.04.2016).
22. Romanova, O. A., Selivanov, E. N. & Korovin, G. B. (2014). *Formirovanie novogo tekhnologicheskogo oblika metallurgicheskogo kompleksa regiona [Forming a new technology image of the region's metallurgical complex]*. Ekaterinburg: UrO RAN Publ., 234.
23. Bernardo, A. E. & Chowdhry, B. (2002). Resources, real options, and corporate strategy. *Journal of Financial Economics*, 63(2), 211–234.
24. Black, F. & Scholes, M. (1973). The pricing the options and corporate liabilities. *Journal of Political Economy*, 3. Retrieved from: <http://www.jstor.org>, (date of access: 12.10.2015).
25. Monkhouse, P. H. L. (1999). *Roadblocks, sleeping policemen and real options*. 3rd Annual real options conference. Retrieved from: <http://www.realoptions.org> (date of access: 10.08.2011).
26. Davis, A. G. & Newman, A. M. *Modern strategic mine planning*. CRC mining conference paper. Retrieved from: <http://www.inside.mines.edu> (date of access: 10.09.2011).
27. Romanova, O. A., Bryantseva, O. S. & Pozdnyakova, E. A. (2013). *Resursnyy potentsial reindustrializatsii staropromyshlennogo regiona [Reindustrialization resource potential of the old industrial region]*. Ekaterinburg: Institut ekonomiki UrO RAN Publ., 251.
28. Romanova, O. A. & Estekhina, I. V. (2014). Strategii razvitiya integrirovannoy struktury na osnove analiza portfelya realnykh optionov [Integrated structure development strategies based on the analysis of the real options portfolio]. *Zhurnal ekonomicheskoy teorii [Journal of the economic theory]*, 3, 171–180.

29. Estekhina, I. V. (2015). *Metodicheskiy instrumentariy ekonomicheskoy otsenki razvitiya integrirovannoy struktury: avtoref. ... diss. kand. ekon. nauk [Methodological tools for the economic assessment of integrated structure development: Author's Abstract ... Cand. of Econ. Sci. Thesis]*. Ekaterinburg: Institut ekonomiki UrO RAN Publ., 26.
30. Romanova, O. A. & Makarov, E. V. (2015). Development trends and economic assessment of the integration processes on the metals market. *New research into regional economy problems*, 1, 164–173.
31. Kazak, A. Yu. & Slepukhina, Yu. E. (2014). Otsenka riska investitsionnykh projektov na finansovykh rynkakh na osnove instrumentov realnykh optionov [Risk assessment of investment projects on financial markets based on real option tools]. *Ustoychivoye razvitie rossiyskikh regionov. Ot Tamozhennogo soyuza k Evraziyskomu. Mat-ly XI mezhdunarod. nauch.-prakt. konf. po problemam ekonomicheskogo razvitiya v sovremennom mire [Sustainable development of Russian regions. From the customs union to the Eurasian Union. Materials of the 11th International Scientific-Practical Conference on the Issues of Economic Development in the Modern World]*. Ekaterinburg: UrFU Publ., 148–156.

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